

**STATE OF FLORIDA  
OFFICE OF THE SECRETARY BRIEFING  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
AND DEPARTMENT OF HEALTH**

**Florida Phosphate Mine Initiative  
Region 4, Waste Management Division**

**June 20, 2005**



***U.S. Environmental Protection Agency***



**Briefing Objective:**

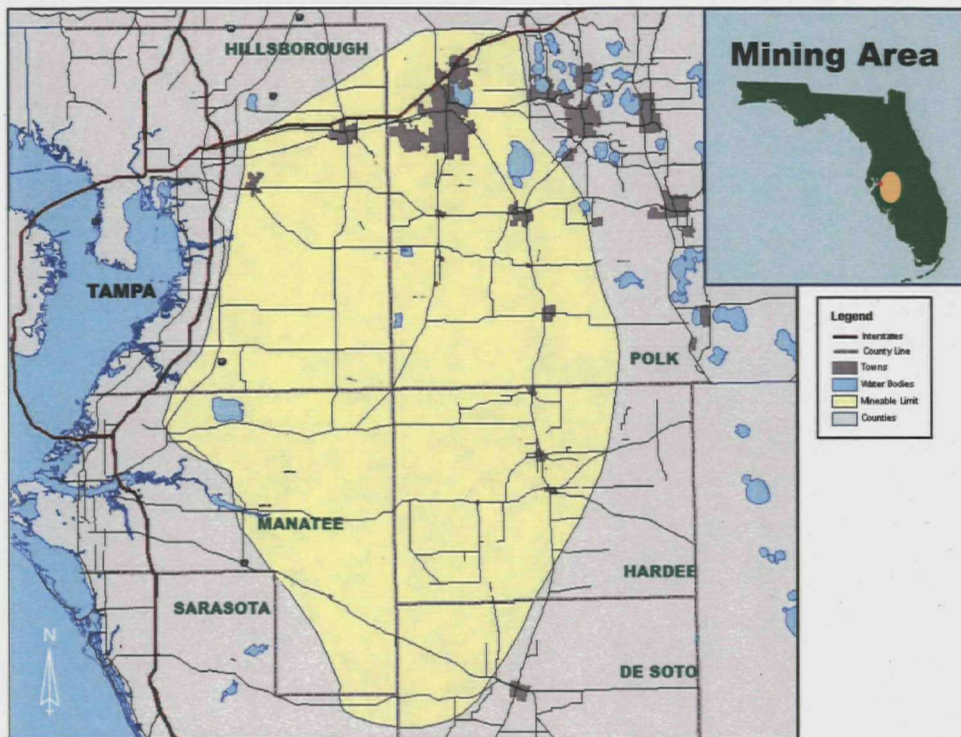
- Review phosphate mining related issues relative to Superfund.
- Discuss potential alternatives for progressing with project.

**Briefing Overview:**

- Brief review of project background
- Primary issues
- Potential Alternatives



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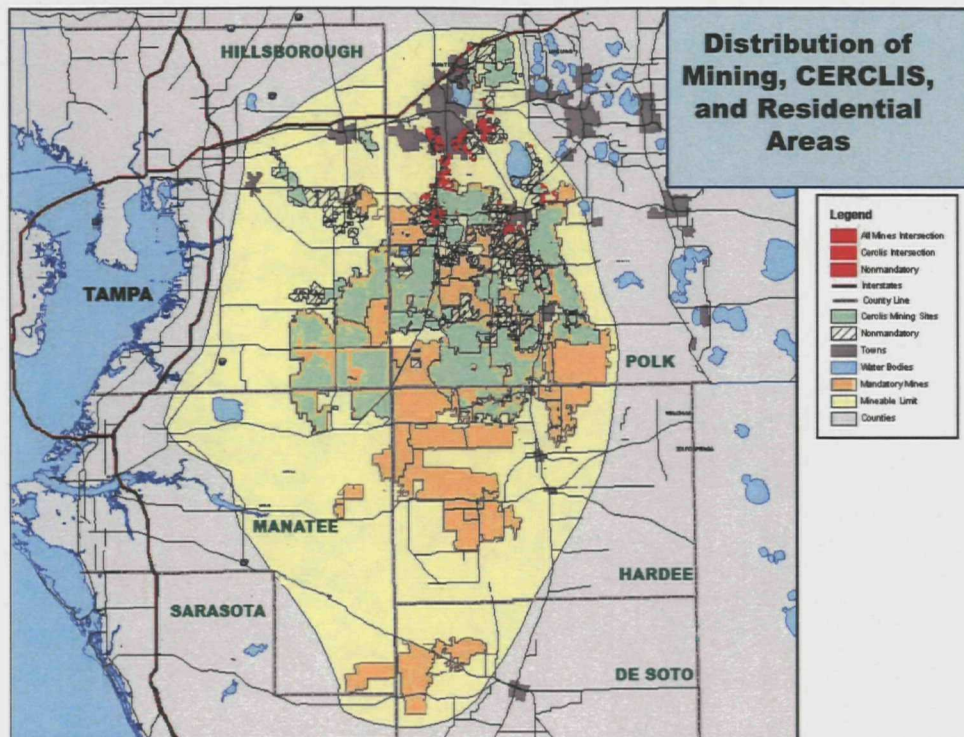
- Phosphate "Belt" or "Mineable Limit" located in west-central Florida and spans an area approx. 2150 mi<sup>2</sup> (1.4 million acres).

- Mineable limit spans six counties...Polk, Hillsborough, Manatee, Hardee, Sarasota, and De Soto.

- Mining began in Polk in the late 1800's and has progressed into Hillsborough, Manatee, and Hardee and efforts are underway to progress further into the southern counties.

- To date, approx. 40% of the mineable limit has either been mined, is in the process of being mined, or is reserved for future mining.





Legend:

Lt. Green - CERCLIS Sites; 337 mi<sup>2</sup> (216,000 acres). GAO audit in 1998 of national CERCLIS database identified numerous older sites with unaddressed risk. In responding to audit, Region 4 identified 21 phosphate mining sites in CERCLIS and began studying the sites collectively to develop a consistent approach. PAs and SIs had been conducted based on chemical contaminants, continued evaluation needed for radiation.

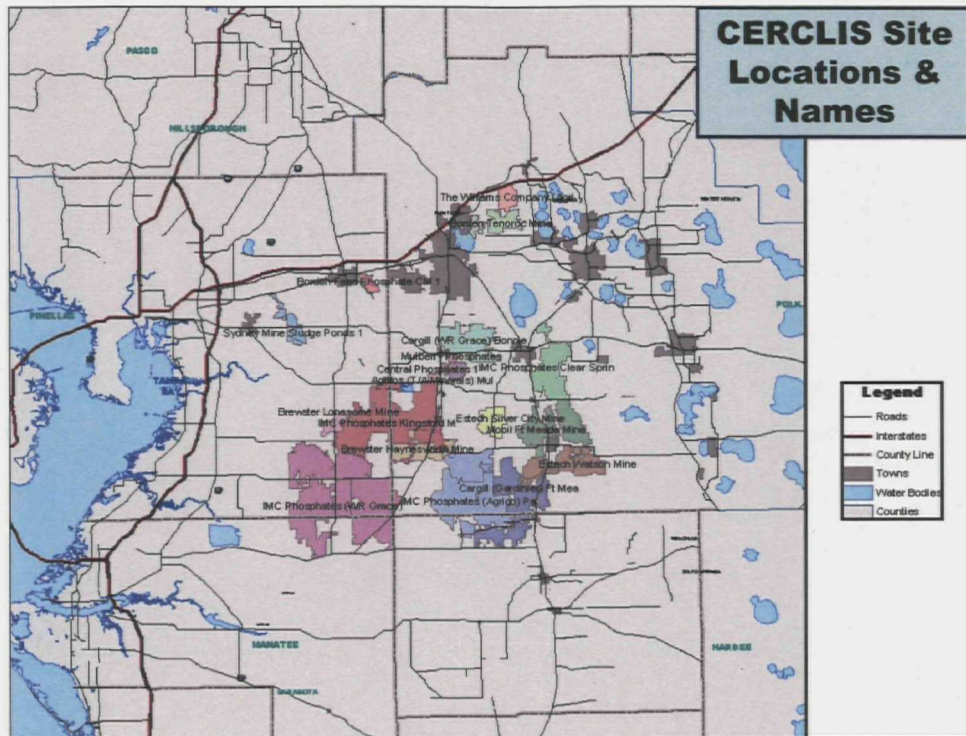
Discovery dates of mining sites generally pre-date CERCLA, believed to be RCRA sites used to populate the start of the CERCLIS database.

Red - Residential Areas overlying formerly mined land; areas identified from residential tax parcel data; 11mi<sup>2</sup> (7000 acres)

Hatched Areas - Non-Mandatory Mined land; land mined prior to 1975; voluntary mine closure; 226 mi<sup>2</sup> (145,000 acres)

Gold - Mandatory Mined Land; generally active mines; formal closure required; 630 mi<sup>2</sup> (400,000 acres)

Lt. Yellow - Mineable limit; 2150 mi<sup>2</sup> (1.4 million acres)



- 1 - Location and names of the 21 phosphate mining sites listed in CERCLIS.
- 2 - Sites are in various stages of operation and closure.
- 3 - Sites generally comprised of mining, processing, sand tailing, and clay settling area.
- 4 - CERCLIS site areas approximately 337 mi<sup>2</sup> or 216,000 acres.

## PHOSPHATE MINES AND OWNERSHIP

- **CURRENT MINING COMPANIES**
  - CF INDUSTRIES (MID-WESTERN CO-OP)
  - MOSAIC (FORMERLY CARGILL AND IMC)
  - PCS PHOSPHATE (CANADIAN COMPANY)
  - USAC (CHINA BASED COMPANY)
- **CERCLIS SITES CURRENT/PAST OWNERS/OPERATORS**
  - AGRICO; WR GRACE; IMC; CARGILL; AMERICAN CYANAMID; KERR-MCGEE; SEMINOLE FERT.; AMAX; CORONET; BORDEN; FARM LAND IND; ESTECH; SWIFT AGRICULTURAL
- **CHRISTINA BLUFFS RESIDENTIAL AREA**
  - W.R. GRACE ORIGINAL OWNER
  - MULTIPLE INDIVIDUAL AND BUSINESS OWNERS
  - CURRENTLY OWNED BY INDIVIDUAL RESIDENTS

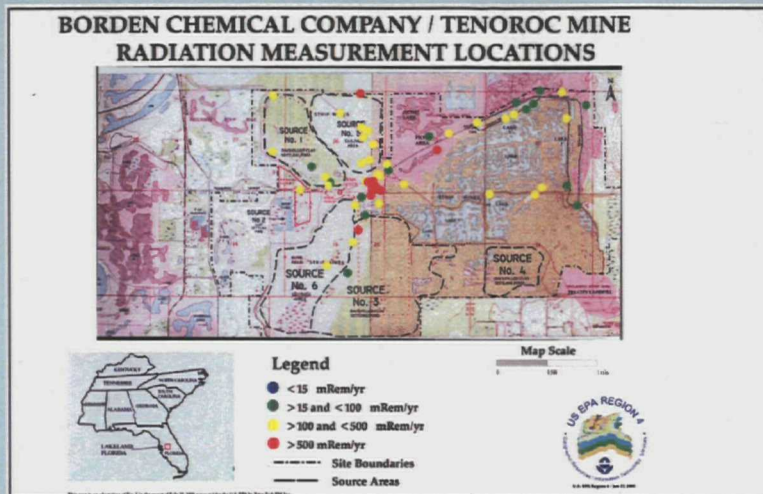
1 - Currently, there are only four companies with active mining operations.

2 - The initial title review of 14 CERCLIS sites indicates the involvement of multiple large companies as owners and operators.

3 - A title search of a residential area (Christina Bluffs) believed to have some of the higher levels of radiation indicates that WR Grace was the original owner/operator. The property has since been sold multiple times and is currently divided into individual residential properties.



## EPA RADIATION DATA UNDEVELOPED MINE



1 - Plot of gamma radiation measurements made by EPA at one of the CERCLIS sites (Tenoroc Mine). Tenoroc is currently a fish management area owned by the State of Florida.

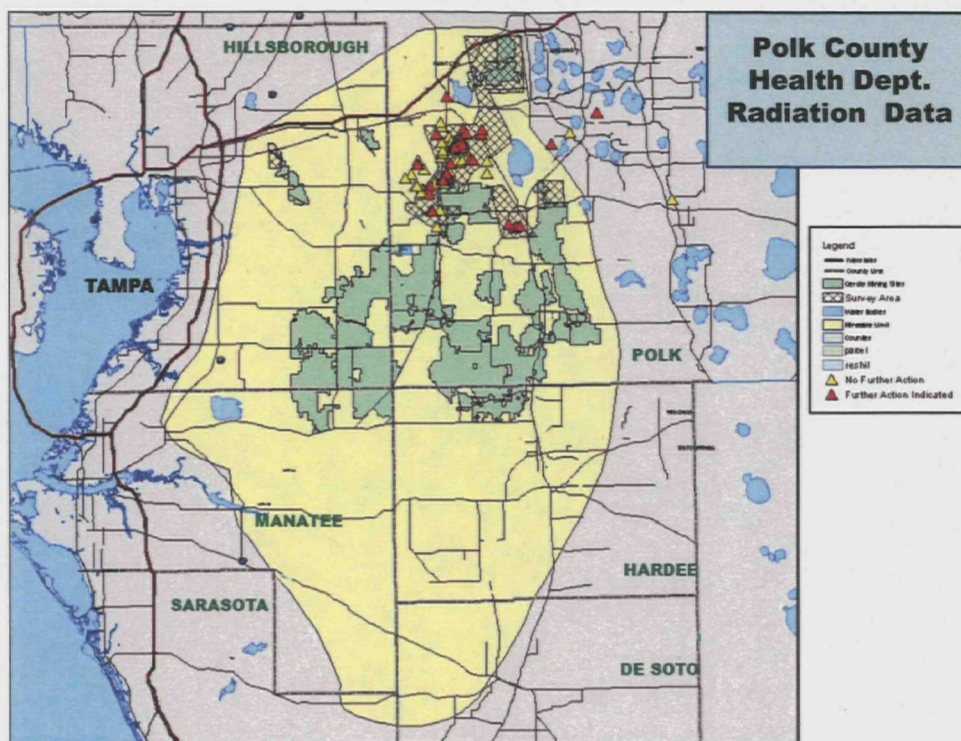
2 - Measurements show elevated levels over the majority of the mine.

Blue - 15 mRem/yr, approx  $10^{-4}$  risk level, EPA guideline under Superfund. Not enforceable.

Green - Locations that exceeds EPA's guideline.

Yellow - Locations that exceed 100 mRem/yr...ATSDR guideline.

Red - Locations that exceed 500 mRem/yr. State recommendation from NCRP upper bound guideline.



1 - Data generally shows that there are areas with radiation levels that exceed EPA's criteria and suggests that further investigation is warranted.

2 - Polk County Health Dept. conducted voluntary radiological monitoring of property from the mid-1970's through the late-1990's.

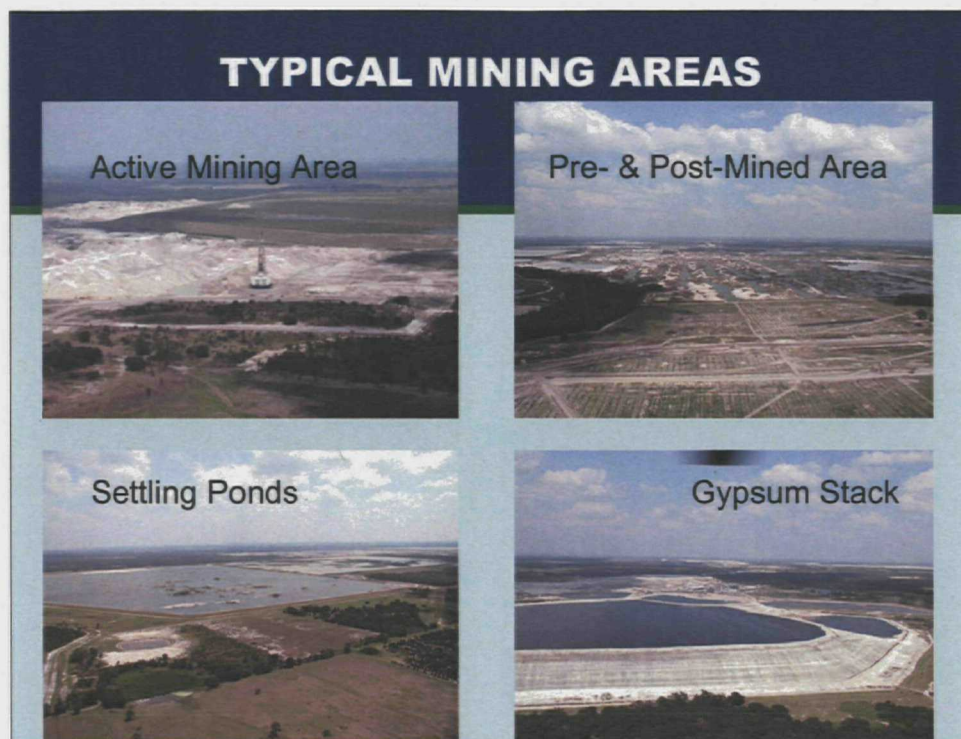
3 - Red Triangles - Areas with measurements that exceeded EPA's screening criterion; Yellow Triangles - Areas free of radiation measurement in excess of EPA's criteria. Approx. 40% of the properties surveyed had a least one location with radiation levels in excess of EPA's 20  $\mu\text{r/hr}$  screening criteria. 170 properties surveyed, totaling several thousand individual measurements.

4 - Only one location, measurements in a school basement had radiation measurements that could exceed the 500 mRem/yr NCRP criterion. Upper range of outdoor measurements in residential areas approached 360 to 420 mRem/yr. Upper range of indoor measurements approached 120 to 180 mRem/yr. (Conversion from activity rate ( $\mu\text{r/hr}$ ) to annual dose (mRem/yr) based a residential conversion factor of 6 (e.g., 60  $\mu\text{r/hr} \times 6 = 360$  mRem/yr).

5 - Data was collected randomly and cannot be used to make any statistical inferences about the distribution of radiation levels. It only shows that there are incidences where EPA's criterion is exceeded and tends to suggest that further investigation is warranted.

6 - DOH has a promulgated standard of 20  $\mu\text{r/hr}$ , but does not have authority to enforce standard. DEP maintains cleanups of chemicals substances must comply with  $10^{-6}$  cancer risk, but does not regulate radiation. Radiation risk issues deferred to DOH.





**Active Mining Area:** Surface mining conducted using large dragline. Ten to 20 ft of overburden typically removed to reach the phosphate ore. The ore is typically 15 to 20-ft thick. Phosphate ore is generally mixed with water to form a slurry and then pumped to processing plants.

**Pre- & Post-Mined Area:** Area has been mined but not reclaimed (i.e., re-graded, re-vegetated, and original hydrology restored).

**Settling Ponds:** A by-products from the removal of clay particles from the ore is the generation of a slurry of a fine clay particles. This clay slurry is stored in impoundments to allow the water to settle out of the clay. The impoundments are generally a square-mile in size.

**Gypsum Stack:** Phosphate rock is reacted with sulfuric acid to form phosphoric acid. Phosphoric acids main use is fertilizer production. A by-product from this process is calcium sulfate (gypsum). Due to elevated levels of radioactivity, the phosphogypsum is not usable and is stored in piles generally a square-mile in size and several hundred feet tall.



## TENORM CRITERIA

Organization	Criteria			
	Dose (mRem/yr)	Exposure Rate (μR/hr)	Ra <sup>226</sup> - Soil (pCi/g)	Chronic Risk
EPA, Superfund	--	20	5	10 <sup>-4</sup> to 10 <sup>-6</sup>
DOD	--	--	5/15	--
DOE	100	--	5/15	ALARA
ATSDR	100	--	--	--
Florida, DOH	--	20	--	--
AL, GA, MS, SC, LA, TX	--	50	5	--
NCRP - General Population	100/500	--	--	ALARA
NCRP - Embryo-fetus	50 (mRem/mo)	--	--	--
CRCPD	100	--	5	--

1 - EPA's over-riding criteria is risk range. 5pCi/g applied as ARAR; 40 CFR 192 (Uranium Mill Tailings Radiation Control Act...UMTRCA). EPA proposed using 20μr/hr (indoor radon gas protection standard from 40 CFR 192) as a screening value for the aerial survey. The 20 μr/hr was originally developed as a criterion for protecting individuals from exposure to elevated levels of radon gas. It has also been applied as a indoor gamma exposure protection criterion.

2 - DOD generally incorporates 40 CFR 192 as ARAR.

3 - DOE Order 5400.5 allows for ALARA, (As Low As Reasonably Achievable), but 40 CFR 192 5 pCi/g often incorporated as ARAR.

4 - ATSDR recommends Minimum Risk Levels of 100 mRem/yr for radiation. MRLs, however, are designed to only address "non-cancer" health effects.

5 - Florida's Administrative Code (FAC 64E-5.1001) establishes 20 μr/hr (including background) as an indoor standard for the protection from excessive radon gas levels. Only used by DOH as guidance.

6 - Most southern states regulates NORM if the source exceeds 50 μr/hr (including bkg.) or Ra exceeds 5 pCi/g. Some states allow higher levels of radium in the subsurface soil if radon gas emissions are not elevated.

7 - NCRP Report No. 116 recommends that radiation protection for the general public be comparable to or less than risks to public in "safe industries"; radiation risks to general public should be less than annual cancer risk of 10<sup>-4</sup>.

NCRP recommends that doses be limited to 100 mRem/y for continuous exposure and 500 mRem/yr for infrequent exposure. (DOH has suggested 500 mRem/yr as an acceptable dose)

NCRP also recommends incorporating ALARA to balance societal needs and cost with protection of public health.

Due to the sensitivity of the embryo-fetus for mental retardation and cancer, NCRP recommends for occupational exposures the monthly dose not exceed 50 mRem/month.

8 - CRCPD (Conference of Radiation Control Program Directors) - provides voluntary radiation guidelines to States. 100 mRem/yr is applied as an exemption level for which releases below this level do not require permitting/regulation. Recommendations provided in CRCPD publication "Implementation Guidance for Regulation and Licensing of Technology TENORM, Part N of the Suggested State Regulations for Control of Radiation".

## **POTENTIAL ALTERNATIVES**

- **ALTERNATIVE 1**  
**EPA ASSESSMENT OF CERCLIS AND RESIDENTIAL AREAS WITH "RISK OPTIMIZATION"**
- **ALTERNATIVE 2**  
**EPA ASSESSMENT OF CERCLIS AREAS & STATE ASSESSMENT OF RESIDENTIAL AREAS**
- **ALTERNATIVE 3**  
**STATE LEAD FOR RESIDENTIAL AND CERCLIS AREAS**

**(This is only an introductory slide...it introduces three alternatives. Try and limit detail discussion to later)**

1 - EPA-lead for assessing both CERCLIS and residential areas. Concept of "Risk Optimization" introduced to policy and decision making process to balance risk reduction, cost, and societal needs. Cleanup would not automatically be started at any places EPA's criteria are exceeded.

2 - Combined approach. EPA addresses CERCLIS sites; and State addresses residential areas.

3 - State-lead in addressing both CERCLIS sites and residential areas. CERCLIS sites referred to State for "re-assessment". State would have option to address all the sites, or if the conditions warrant, the site could be referred back to EPA.



## **ALTERNATIVE 1 EPA LEAD COMBINED ASSESSMENT WITH RISK OPTIMIZATION**

- **EPA LEAD IN ASSESSING CERCLIS AND RESIDENTAL AREAS**
- **EFFORTS FOCUSED ON AREAS WHERE THE GREATEST RISK REDUCTION CAN BE ACHIEVED**
- **RISK MANAGEMENT DECISIONS CONSIDER RISK REDUCTION, RISK UNCERTAINTIES, COSTS, AND SOCIETAL NEEDS ("RISK OPTIMIZATION")**
- **CLEANUP UNDERTAKEN COMPLIANT WITH CERCLA RISK AND ARARS**

1 - Initial step would be a radiological assessment of both CERCLIS and residential areas using aerial and ground-based survey techniques.

2 - Prior to assessment, Risk Optimization protocols would be developed in cooperation with the State and HQ. Protocols would establish process for conducting individual dose and risk-based assessments. The results from this analysis would be evaluated in light of other issues such as risk estimate uncertainties, cost, and other societal impacts relative to the anticipated reduction in risk.

For example, if the estimated risk for a particular resident was estimated at  $10^{-3}$  from contaminants disbursed over the entire property, and the only way to reduce the risk would be through relocation of the resident, or excavation of the yard. In this case, the societal impacts from either permanently or temporarily relocating the resident, the risk from excavating and transporting the material for disposal, as well as the significant cost for the cleanup, EPA and the State may determine that the risks from other societal impacts out-weight the benefits associated with the cleanup and reduction in risk by only one order of magnitude (i.e.,  $10^{-3}$  to  $10^{-4}$  (natural background)). Risks could also be managed through education to limit exposure/risks.

3 - Other cases with higher risk levels, or risks due to higher levels of radiation in discrete locations may warrant traditional cleanup alternatives.

4- If cleanup of a residential area was needed, cleanup would need to meet CERCLA risk criteria and ARARs.

## **RISK OPTIMIZATION CONCEPT**

- **PROCESS THAT CONSIDERS UNCERTAINTIES IN RISK ESTIMATION, SOCIETAL ISSUES, AND COST WHEN RISK ARE marginally ABOVE RISK RANGE**
- **PROCESS APPLIED IN INITIAL SITE EVALUATION AND DECISION MAKING PROCESS, PRIOR TO REMEDY SELECTION AND NINE-CRITERIA EVALUATION**
- **BACKGROUND CURRENTLY 10-4, CONCEPT GENERALLY APPLIED IN THE RANGE OF 10-3 RISKS**
- **RISKS APPROACHING 10-2 WOULD GENERALLY REQUIRE TRADITIONAL CLEANUP**

1 - Risk Optimization process that attempts to address situations where the cost of incremental risk reduction is out weighted by societal costs and monetary costs.

2 – CERCLA and the NCP require that any remedial action undertaken be protective of human health (10-4 to 10-6 risk range) and comply with ARARs.



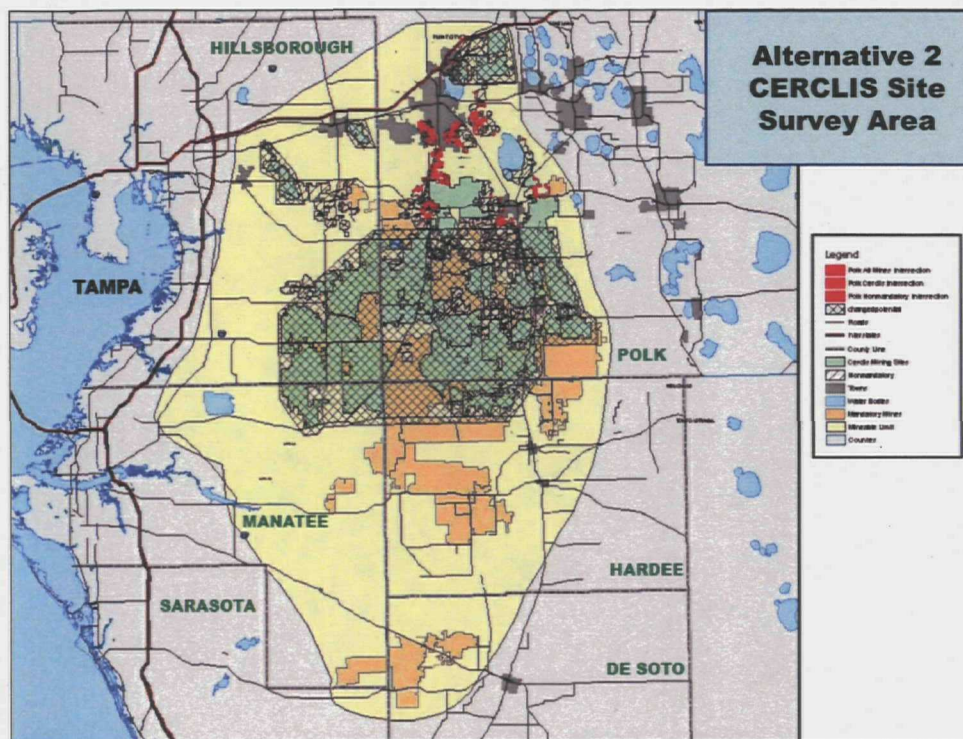


## **ALTERNATIVE 2 SEPARATE ASSESSMENTS**

- **EPA ASSESSMENT OF CERCLIS SITES & STATE ASSESSMENT OF RESIDENTIAL AREAS**
- **CERCLIS AREA CRITERIA BASED ON CERCLA RISK RANGE AND ARARS**
- **ALLOWS STATE TO DETERMINE CRITERIA FOR RESIDENTIAL AREA**
- **MAY REQUIRE PUBLIC EXPLANATION FOR DIFFERENT NON-DEVELOPED & RESIDENTIAL CRITERIA**

- 1 - EPA-lead in assessing CERCLS site; assessment based on CERCLA risk range ( $10^{-4}$  to  $10^{-6}$ ) and ARARs (5 pCi/g).
- 2 - State-lead in assessing residential areas; assessment based on NCRP upper-bound level of 500 mRem/yr.
- 3 - May initially avoid the application of CERCLA risk range and ARARs to residential areas, but may need to eventually deal with inconsistencies in criteria.
- 4 - Once EPA's assessment becomes public, residents currently living over formerly mined land may wonder why EPA is not including residential areas as well. When the public realizes that the State has the lead to address residential areas, but with criteria several orders of magnitude less stringent than that being used by EPA for non-developed areas, both EPA and the State will be hard-pressed to provide a logical explanation that the public will accept.
- 5 - EPA and State may be forced into a combined assessment.





1 - Hatched area denotes survey area for just CERCLIS sites.

2 - Survey area approx. 700 mi<sup>2</sup>.

### **ALTERNATIVE 3 STATE LEAD RESIDENTIAL AND CERCLIS**

- **RESIDENTIAL AREAS ADDRESSED BY STATE**
- **CERCLIS SITES REFERRED TO STATE FOR REASSESSMENT**
- **CERCLIS SITES PLACED IN "OTHER CLEANUP AUTHORITY" CATEGORY**

1 - Residential areas addressed by State using criteria selected by State. State may choose to seek EPA assistance if conditions warrant.

2 - 21 Phosphate mining related sites in CERCLIS referred to, and accepted by, State for reassessment.

3 - Several factors that support referral to State:

- CERCLIS site discovery dates pre-date CERCLA and were obtained from a RCRA listing to help develop an initial CERCLA database.
- State did not have an opportunity to comment on appropriateness of site being addressed under Superfund.
- State has both a phosphate mining and radiation program to address mining and radiation related issues.

4 - State requests that CERCLIS sites placed in "Other Cleanup Authority" category in EPA CERCLIS database. This addresses EPA's obligation to bring the sites to completion and respond to GAO audit that old sites with "unaddressed risk" are being addressed.